Poster Presenters (in alphabetical order)

1. Bhattacharyya, Arpan and Hung, Ling Yang

   “Instantons and Entanglement Entropy”,

   We consider non perturbative solutions of the field theory (for example instantons) and explore entanglement entropy corresponding to these solutions. We further model these theories by some simple lattice theories and explore whether the entropy satisfies area law and check the Lieb-Robinson bound. As we know that entanglement entropy for local field theory satisfies area law and it is quite robust, in light if this context our results play an important. To establish the area law for the entanglement entropy for local field theory one has to also consider these important non perturbative topological sector of the solutions of the underlying field theory and we will explore some interesting consequence of our findings.

2. Brehm, Enrico Mohandas

   “Entanglement Entropy and Conformal Interfaces”,

   We consider entanglement entropies in two-dimensional conformal field theories in the presence of topological interfaces. Tracing over one side of the interface, the leading term of the entropy remains unchanged. The interface however adds a subleading contribution, which can be interpreted as a relative (Kullback-Leibler) entropy with respect to the situation with no defect inserted. Reinterpreting boundaries as topological interfaces of a chiral half of the full theory, we rederive the left/right entanglement entropy in analogy with the interface case, too.

3. Callebaut, Nele and Zukowski, Claire Elizabeth

   “Kinematic space of quotient spaces of AdS3”,

   The kinematic space of (a constant time slice of) AdS3 has been shown to be a 2-dimensional de Sitter space in 1505.05515. The kinematic spaces of quotients of AdS3, such as BTZ or AdS3 with a conical singularity, correspond to particular parts of that de Sitter. I will present these kinematic spaces and their implications, e.g. in the context of issues with bulk geometry reconstruction from boundary entanglement data.

4. Cao, ChunJun

   “Emergent Geometries in Redundancy-Constrained States and Bulk Entanglement Gravity”, In light of the recent progress in geometry from entanglement, we present a framework that attempts to identify the corresponding emergent geometries knowing only the states and their entanglement structures. We show that a reasonable reconstruction of spatial geometry can be obtained for certain "redundancy-constrained" states outside the context of AdS/CFT. In addition, we also show that non-local entanglement perturbation with respect to the emergent geometry gives rise to an analog of the Einstein's equation.

5. Flory, Mario Rainer

   "Entanglement Entropy in a Holographic Kondo Model",

   We calculate entanglement and impurity entropies in a holographic model of a magnetic impurity interacting with a strongly coupled system. There is an RG flow to an IR fixed point where the impurity is screened, leading to a decrease in impurity degrees of freedom. This information loss corresponds to a volume decrease in our dual gravity model, which consists of a codimension one hypersurface embedded in a BTZ black hole background in three dimensions. There are matter fields defined on this hypersurface which are dual to Kondo field theory operators. In the large N limit, the formation of the Kondo cloud corresponds to the condensation of a scalar field. We find that the larger the scalar condensate gets, the more the volume of constant time slices in the bulk is reduced, shortening the bulk geodesics and reducing the impurity entropy. This provides a new non-trivial example of a holographic RG flow satisfying the g-theorem. Moreover, we find explicit expressions for the impurity entropy at low temperatures which are in agreement with previous field theory results for free electrons. This demonstrates the universality of perturbing about an IR fixed point.

6. Fujita, Mitsutoshi

   "Towards a Holographic Bose-Hubbard Model",

   In this presentation, we review our paper of a holographic Bose-Hubbard model. We present a holographic construction of the large-N Bose-Hubbard model. The model is based on Maxwell fields coupled to charged scalar fields on the AdS_2 hard wall. We realize the lobe-shaped phase structure of the Bose-Hubbard model and find that the model admits Mott insulator ground states in the limit of large Coulomb repulsion. In the Mott insulator phases, the bosons are localized on each site. At zero hopping we find that the transitions between Mott insulating phases with different fillings correspond to first order level-crossing phase transitions. At finite hopping we find a holographic phase transition between the Mott phase and a non-homogeneous phase. We then analyze the perturbations of fields around both the Mott insulator phase and inhomogeneous phase. We find an almost zero mode in the non-homogeneous phase.

7. Fujita, Hiroyuki

   "Fractional quantum Hall states of dipolar fermions in a strained optical lattice",

   We consider interacting fermionic atoms in a honeycomb optical lattice with spatial variations in hopping amplitudes. Similar to a strained graphene, such spatial variations produce valley-dependent effective magnetic fields for atoms near the two Dirac points, resulting in the formation of Landau levels [B. Tian et al. Phys. Rev. Lett. 115, 236803 (2015)]. This setup offers a unique platform for observing interaction effects in Landau levels in a static optical lattice, avoiding heating effects present in other related schemes. Here we study fractional quantum Hall states arising from fermionic atoms with magnetic or electric dipole moments loaded in such a "strained" honeycomb optical lattice. The dipole moments are polarized perpendicular to the honeycomb plane, giving rise to long-range dipole-dipole interactions. By exact diagonalization in the lowest-Landau-level basis, we find that the ground states are fully valley-polarized for all the filling factors, and there appear a series of fractional quantum Hall states such as Laughlin and composite-fermion states. We give estimates for the energy gaps above these incompressible ground states, and discuss the temperature scale required for their experimental realization.

8. Galante, Damian Andres

   "Shape dependence of holographic Rényi entropies",

   Rényi entropies in a QFT can be computed in principle using the replica trick, which amounts to the insertion of a co-dimension two twist operator in the path-integral. In a conformal field theory in the vacuum state, the effect of small shape deformations around a spherical or flat entangling surface is encoded in a piece of CFT data associated to this defect. A method to extract this quantity holographically in general dimensions is described. The result of this computation shows that previous conjectures (based on free field theory results) are not true in holographic theories.

9. Goulart Santos, Prieslei E D

   "Dyonic extremal Black hole entropy for $\mathcal{N} = 8$ gauged supergravity",

   Using the Sen's entropy function formalism, we compute the entropy for the extremal dyonic black hole solutions of theories in the presence of dilaton field coupled to the field strength and a dilaton potential. We solve the attractor equations analytically and determine the near horizon metric, the value of the scalar fields and the electric field on the horizon, and consequently the entropy of these black holes. The attractor mechanism plays a very important role for these systems, and after studying the simplest systems involving dilaton fields, we propose a general solution for the value of the scalar field on the horizon, which allows us to solve the attractor equations for gauged supergravity theories in AdS_4 spaces.

10. Hanada, Masanori

“Toward Experimental Quantum Gravity with Cold Atoms”,

We argue that a small, quantum black hole can be made from atoms and lasers.

There are two key ingredients: the holographic principle and the quantum simulator. The holographic principle claims that the quantum gravitational systems, typically superstring theory, is equivalent to non-gravitational quantum systems, typically super Yang-Mills theory. Here the ’equivalence’ means two theories cannot be distinguished even in principle. Therefore, if the holographic principle is true, then by engineering the non-gravitational systems as quantum simulators one can create actual quantum black holes.

In this presentation, we consider the simplest example: the Sachdev-Ye-Kitaev (SYK) model. We design a quantum simulator of the SYK model by using Lithium 6.

This presentation is based on a paper ”Toward Experimental Quantum Gravity with Cold Atoms” with Ippei Danshita (Yukawa Institute for Theoretical Physics, Kyoto University) and Masaki Tezuka (Deptartment of Physics, Kyoto University).

11. Hongo, Masaru

“Emergent curved spacetime from locally thermalized matter”,

We develop imaginary-time formalism for quantum field theories in the case of local thermal equilibrium. We show microscopically that the Masseiu-Planck functional, which is a thermodynamic potential for locally thermalized systems, plays a role as the generating functional for the expectation values of conserved current operators such as the energy-momentum tensor over the local Gibbs distribution. We provide the complete path-integral formulation of the Masseiu-Planck functional, in which the Masseiu-Planck functional is written in terms of the emergent curved spacetime, and show this thermal spacetime possesses the notable intrinsic symmetry properties: Kaluza-Klein gauge symmetry, spatial diffeomorphism symmetry, and gauge symmetry for external fields.

12. Huang, Xing

“Some applications of integral geometry in AdS/CFT correspondence”,

We revisit the applications of integral geometry in AdS3 and argue that the measure of the kinematic space can be realized as the entanglement contour, which is defined as the additive contribution to the entanglement entropy of a point. We study the renormalization of the entanglement contour in the framework of surface/state correspondence. The entanglement contour runs in a simple way that is consistent with the operations of disentangler and isometry in multi-scale entanglement renormalization ansatz. We then generalize this integral geometric construction to higher dimensions and in particular demonstrate how it works in bulk space of homogeneity and isotropy.

13. Imamura, Yukihisa

    "Coupled Wire Construction and generalized Wilson line",

    Topologically ordered state is the phase of a many-body system which has a long-range entanglement pattern. Recently, Coupled Wire Construction (CWC) has been proposed as a new method of systematically obtaining two-dimensional topologically ordered states. It is formulated by using an array of one-dimensional wires on a plane and interactions between the wires. However, the conventional formulation has two problems, namely, the breaking of local gauge invariance and the lack of the bulk theory. In order to avoid these difficulties, we reformulate CWC by introducing the Wilson line and show that the Wilson line must be modified for maintaining the ground state of the topological phases. In this poster, taking Laughlin states for a main example, it will be shown how the Modified Wilson line is introduced and (2+1)d level-m U(1) Chern-Simons gauge theory naturally arises from the modification. I also would like to refer to the relationship between the Modified Wilson line and the long-range entanglement structure of the Laughlin state.

14. Kashiwa, Kouji

    "Topological phase transition in QCD described by using imaginary chemical potential",

    The confinement-deconfinement transition is investigated by using the imaginary chemical potential. We can interpret the imaginary chemical potential as the Aharonov-Bohm phase, then the analogy of the topological order suggests that the Roberge-Weiss endpoint would define the pseudo-critical temperature of the transition. Also, we propose a new quantity which describes the confinement-deconfinement transition based on topological properties of QCD. The quantity which we call the quark number holonomy is defined as the integral of the quark number susceptibility along the closed loop of the imaginary chemical potential.

15. Kawakubo, Ryuitiro

    "Distinguishability of countably many states",

    First, we drive a necessary and sufficient condition for countably many states being distinguishable, where we define distinguishability as possibility of an unambiguous discrimination on the states. The condition is minimality or Riesz-Fischer property, which is akin to linear independence. Second, we investigate the von Neumanns lattice, which are the families of coherent states corresponding to two-dimensional lattices in the classical phase space. Owing to the criteria presented in the first part, we see a drastic change in distinguishability of the states when the fundamental region of the lattice became the Planck constant h.

16. Khveshchenko, Dmitri

    "Demystifying the Holographic Mystique",

    Despite great efforts, the progress towards a systematic study and classification of various 'strange' metallic states of matter has been rather slow. To that end, it has been argued that the recent proliferation of the ideas of holographic correspondence originating from string theory might offer a possible way out of the stalemate. However, despite a recent flurry of the attempts to apply the broadly defined ('non-AdS/non-CFT') holographic correspondence to a variety of condensed matter problems, the status of this intriguing approach remains largely undetermined. This discussion aims at ascertaining the true (as opposed to the desired) status of the applications of holography to condensed matter systems and elucidating the conditions under which it might indeed work.

17. Kim, Kyung Kiu

    "Holographic Entanglement Entropy of Anisotropic Minimal Surfaces in LLM Geometries",

    We calculate the holographic entanglement entropy (HEE) of the Z_k orbifold of Lin-Lunin-Maldacena (LLM) geometries which are dual to the vacua of the mass-deformed ABJM theory with Chern-Simons level k. By solving the partial differential equations analytically, we obtain the HEEs for all LLM solutions with arbitrary M2 charge and k up to μ_0^2-order where μ_0 is the mass parameter. The renormalized entanglement entropies are all monotonically decreasing near the UV fixed point in accordance with the F-theorem. Except the multiplication factor and to all orders in μ_0, they are independent of the overall scaling of Young diagrams which characterize LLM geometries. Therefore we can classify the HEEs of LLM geometries with Z_k orbifold in terms of the shape of Young diagrams modulo overall size. HEE of each family is a pure number independent of the 't Hooft coupling constant except the overall multiplication factor. We extend our analysis to obtain HEE analytically to μ_0^4-order for the symmetric droplet case.

18. Koshida, Shinji

"Dynamic correlation of Kitaev's honey-comb model",

We investigate the state space of Kitaev's honey-comb model, a model of quantum spins, which is mapped to a tight-binding model of Majorana fermions coupled to Z2-gauge fields acting on an enlarged Hilbert space. Then each eigenvector is obtained by projection from the enlarged space to the physical subspace. We compute matrix elements of a quantum spin, which does not act on a single representation of fermions, but is an operator from one representation to another, with respect to a convenient basis. As an application, we present a way to compute dynamic correlation of Kitaev's honey-comb lattice.

19. Lee, Jung Hun

    "Time-evolution of holographic entanglement entropy and Metric perturbations",

    We study the holographic entanglement entropy under small deformations of AdS, including time-dependence. We also consider the entanglement thermodynamic first law, and calculate the entanglement temperature and confirm that it is inversely proportional to the size of the entangling region.

20. Luo, Zhuxi

    "Quantum Entanglement in Topological Phases on Torus",

    To study how the non-trivial spatial topology affects quantum entanglement in a topological phase, we examine the degenerate ground state subspace on a torus, which is partitioned into two cylinders. We propose a general formula for reduced density matrix and entanglement entropy on a torus, for ground state wave functions of string-net type. Diagonalized reduced density matrices are determined by the bulk-boundary correspondence for a cylinder. We prove that our proposal reproduces known result for entanglement entropy on a disk-shaped region. Concrete examples on torus with data from both finite groups and quantum groups are demonstrated, and support from direct computations with the number of boundary links up to $L = 9$ is provided for all examples discussed. Consequences for minimally entangled states, Rényi entropies and entanglement spectrums are also derived.

21. Martin, Victoria,

    "Spectral Weight in Holographic Superfluids",

    The spectral weight is an important and interesting field theoretic quantity. It directly counts the number of degrees of freedom at a given momentum. Therefore, calculating a nonzero value for the spectral weight at low energy and over a finite range of momenta is a signature of a Fermi surface. In a previous work, we calculated the low energy spectral weight for a semi-local quantum liquid in a holographic setting, and discovered that it was nonzero over a finite range of momenta. We attributed this Fermi surface behavior to the charges existing behind the black hole horizon. In this work, we calculate the spectral weight for a holographic superfluid. One would expect to find zero spectral weight in this situation, since here the bulk charges are in front of the horizon and manifestly form a condensate. Surprisingly, we find a result to the contrary, which raises interesting questions about bulk degrees of freedom and/or the connection between the bulk and boundary charge distributions.

22. Matsumura, Akira

    "Quantum Entanglement in the de Sitter Spacetime",

    We examine quantum entanglement of the Bunch-Davies vacuum for a massless scalar field in the de Sitter spacetime. For numerical analysis of time evolution of the entanglement, we use a lattice version of the scalar field and introduce two adjacent symmetrical regions onto the lattice space. Regarding the vacuum as a Gaussian state, we apply a well-known method to calculate the logarithmic negativity which characterizes the bipartite entanglement between the two regions. In general, it is not enough to look over the logarithmic negativity to decide whether a state for a bipartite system is separable. However, for a Gaussian state there exists an algorithm which judges that the state is separable. For these two analysis, we investigate exactly if the reduced density operator of the Bunch-Davies vacuum for the two regions is separable or not, and we find a relation between a size of the region and a time scale in which the bipartite entanglement disappears. In this way, we want to clarify a relation between the structure of the de Sitter spacetime and quantum entanglement.

23. Mohammadi Mozaffar, Mohammad Reza

    "Holographic Entanglement Entropy (HEE) and Field Redefinition Invariance",

    It is established that physical observables in local quantum field theories should be invariant under invertible field redefinitions. It is then expected that this statement should be true for the entanglement entropy and moreover that, via the gauge/gravity correspondence, the recipe for computing entanglement entropy holographically should also be invariant under local field redefinitions in the gravity side. We use this fact to fix the recipe for computing holographic entanglement entropy (HEE) for $f(R, R_{\mu\nu})$ theories which could be mapped to Einstein gravity. An outcome of our prescription is that the surfaces that minimize the corresponding HEE functional for $f(R, R_{\mu\nu})$ theories always have vanishing trace of extrinsic curvature and that the HEE may be evaluated using the Wald entropy functional. We show that similar results follows from the FPS and Dong HEE functionals, for Einstein manifold backgrounds in $f(R, R_{\mu\nu})$ theories.

24. Mollabashi, Ali

    "Field Space Entanglement: Scalar Fields"

    I will review the notion of entanglement in the field space. Focusing on scalar field theories which are entangle due to interactions between them, I introduce a family of solvable models as a laboratory to study field space entanglement and calculate several entanglement measures between generic subsets of these scalar fields analytically. I will end with some comments about possible holographic duals of such models.

25. Murashita, Yuto

    "The Gibbs paradox revisited from the fluctuation theorem with absolute irreversibility"

    The Gibbs paradox has raised fundamental questions on thermodynamics and statistical mechanics. Here, we consider one face of the Gibbs paradox, consistency between thermodynamics and statistical mechanics. In this context, it has been known that the requirement of extensivity resolves the Gibbs paradox. However, we cannot apply this resolution to small thermodynamic systems due to the breakdown of extensivity. We offer a resolution applicable to small thermodynamic systems based on our fluctuation theorem.

26. Nakagawa, Yuya

    "Flux quench in a system of interacting spinless fermions in one dimension",

    We study a quantum quench in a one-dimensional spinless fermion model (equivalent to the S=1/2 XXZ chain), where a magnetic flux is suddenly turned off. This quench is equivalent to imposing a pulse of electric field and therefore generates an initial particle current. This current is not a conserved quantity in presence of the lattice and the interactions, and thus shows a nontrivial time-evolution after the quench. We investigate this phenomenon numerically, using the infinite time-evolving block decimation (iTEBD) method. For repulsive interactions or large initial flux, we find oscillations that are governed by excitations deep inside the Fermi sea. At long times we observe that the current acquires some finite value in the gapless cases, whereas it decays to zero in the gapped cases. Although the linear response theory (valid for a weak flux) predicts the same long-time limit of the current for repulsive and attractive interactions (relation with the zero-temperature Drude weight), larger nonlinearities are observed in the case of repulsive interactions compared with that of the attractive case.

27. Negoro, Makoto

    "Quantum annealing with hyperpolarized nuclear spins",

    TBA

28. Ohta, Takumi

    "Entanglement dynamics of Majorana fermions",

    We study the sweep dynamics of a one-dimensional model with competing interactions of Majorana fermions. We then investigate the dynamical properties during interaction sweeps through the critical point of topological phase transition. In the dynamics, the string correlation function and the entanglement entropy exhibit spatially periodic structures and the levels in the entanglement spectrum (ES) oscillate in time. By explicitly calculating the above quantities for excited states, we attribute these behaviors to the Bogoliubov quasiparticles generated near the critical point. We also show that the ES reflects the strength of the Majorana correlation even for the excited states.

29. Richter, Benedikt

    "Universality of Black Hole Quantum Computing",

    By analyzing the key properties of black holes from the point of view of quantum information, we derive a model-independent picture of black hole quantum computing. It has been noticed that this picture exhibits striking similarities with quantum critical condensates, allowing the use of a common language to describe quantum computing in both systems. We analyze such quantum computing by allowing coupling to external modes, under the condition that the external influence must be soft-enough in order not to offset the basic properties of the system. We derive model-independent bounds on some crucial time-scales, such as the times of gate operation, decoherence, maximal entanglement and total scrambling. We show that for black hole type quantum computers all these time-scales are of the order of the black hole half-life time. Furthermore, we construct explicitly a set of Hamiltonians that generates a universal set of quantum gates for the black hole type computer. We find that the gates work at maximal energy efficiency. Furthermore, we establish a fundamental bound on the complexity of quantum circuits encoded on these systems, and characterize the unitary operations that are implementable. It becomes apparent that the computational power is very limited due to the fact that the black hole life-time is of the same order of the gate operation time. As a consequence, it is impossible to retrieve its information, within the life-time of a black hole, by externally coupling to the black hole qubits. However, we show that, in principle, coupling to some of the internal degrees of freedom allows acquiring knowledge about the micro-state. Still, due to the trivial complexity of operations that can be performed, there is no time advantage over the collection of Hawking radiation and subsequent decoding.

30. Ruggiero, Paola

    "Entanglement Negativity in Random Spin Chains",

    Entanglement measures are nowadays accepted as powerful tools to characterize quantum many-body systems. A computable measure of the mutual entanglement between two subsystems (both if they are in a pure or in a mixed quantum state) is provided by the so-called logarithmic negativity, which has recently became the focus of several interdisciplinary studies, mainly due to a new replica approach that allows to evaluate it in a quantum field theory framework. Our work focus on the negativity in random spin chains. In particular, using "strong disorder renormalization group" (SDRG) techniques, we compute its scaling behavior for systems whose ground state flows under RG to the so-called "random singlet phase" (which is the case for the XX, the Ising and Heisenberg random chain). Our predictions are confirmed using a numerical implementation of the SDRG method.

31. Seki, Shigenori

    "Entanglement Entropy of Scattering Particles",

    We study the entanglement entropy between the two outgoing particles in an elastic scattering process. It is formulated within an S-matrix formalism using the partial wave expansion of two-body states, which plays a significant role in our computation. As a result, we obtain a novel formula that describes the entanglement entropy in a high energy scattering by the use of physical observables, namely the elastic and total cross sections and a physical bound on the impact parameter range, related to the elastic differential cross-section.

32. Shiozaki, Ken

    "Z_4 Topological crystalline insulators and superconductors",

    It is known that topological phases of free fermions with the lattice translational symmetry are classified by the K-theory. This includes bulk gapped phases, gapples anomalous surface states which can not be realized in a lattice model, and topologically stable fermi nodes, For bulk gapped phases in d-space dimensions, we consider the twisted equivariant K-theory over the Brillouin zone torus T^d. The datum of symmetries such as time-reversal symmetry and space group are encoded in the group action on the Brillouin zone torus and the twist field. I will present some examples of Z_4 topological phases in bulk, surface gapless state, and fermi point.

33. Sim, Heung-Sun

"Sudden Death and Birth of Topological Entanglement in 1D Fermions at Finite Temperature",

Topological phases of matter possess zero-temperature quantum orders (QOs), identified by topological quantities such as Chern numbers and topological entanglement entropy. It remains largely unexplored how these QOs are suppressed thermally. An essential step for exploring this is to find topological quantities applicable to thermal states. Here, we propose a topological quantity for a one-dimensional superconductor at finite temperature. The topological quantity is defined by an entanglement measure for mixed states (such as the entanglement of formation and the negativity), and it identifies a QO, "number-parity entanglement" formed by Majorana fermions in the topological phase of the superconductor. It reveals that the QO survives below certain temperature and then vanishes suddenly in a nonanalytic manner. Even when the superconductor has a topologically trivial ground state, the QO appears suddenly within a temperature window. These sudden behaviors are in contrast with usual quantum-to-classical crossover, but akin to entanglement sudden death and birth. Our findings extend the notion of the topological phase from ground to thermal states.

34. Sin, Sang-Jin

"Character of matter in holography",

Gauge/Gravity duality as a theory of matter needs a systematic way to characterise a system. We suggest a 'dimensional lifting' of the least irrelevant interaction to the bulk theory. As an example, we consider the spin-orbit interaction, which causes magneto-electric interaction term. We show that its lifting is an axionic coupling. We present an exact and analytic solution describing diamagnetic response. Experimental data on annealed graphite shows a remarkable similarity to our theoretical result. We also find an analytic formulas of DC transport coefficients, according to which, the anomalous Hall coefficient interpolates between the coherent metallic regime with ρ2xx and incoherent metallic regime with ρxx as we increase the disorder parameter β. The strength of the spin-orbit interaction also interpolates between the two scaling regimes.

35. Takahashi, Jun

"Fidelity approach to Adiabatic Quantum Computation of hard problems",

Adiabatic Quantum Computation (AQC, aka quantum annealing) is known to be the state of the art quantum computer which has been realized to a large qubit size. It is known that the inverse gap corresponds to the necessary computation time and gapless points in the corresponding quantum spin systems is the main obstacle for efficient computation in AQC. Since it is strongly conjectured that NP subseteq BQP in computational complexity, we expect that there should be an exponentially small gap for AQC spin systems computing hard problems. However, different scenarios such as avoided crossings, Anderson localization, or spin glass transitions has been argued for the mechanism of the exponentially small gap, and no physical picture has been established. We use Stochastic Series Expansion, a quantum Monte Carlo method to analyze the transition in computing an NP-hard problem by AQC. We see the fidelity susceptibility which has been argued to be a good measure for transitions when we do not know the order parameter exactly.

36. Tezuka, Masaki

"Numerical study of the Sachdev-Ye-Kitaev model",

The Sachdev-Ye-Kitaev (SYK) model has attracted a lot of attention recently in the context of black hole physics. We numerically study various aspects of the SYK model. If time allows, we would also like to discuss the possibility of realizing the model experimentally. This work has been done in collaboration with Guy Gur-Ari, Masanori Hanada, and Stephen Shenker.

37. Turzillo, Alex

"Classifying Gapped Quantum Phases with Tensor Networks and TQFTs",

We establish a dictionary between the matrix product states and the topological quantum field theory classifications of gapped phases of 1+1 dimensional quantum matter that allows us to explicitly construct tensor networks for ground states of abstract lattice TQFTs. An extension of the correspondence includes fermionic phases and phases protected by symmetry. In particular, we discuss how spin cobordism and group cohomology phases fit into this framework.

38. Wong, Anson

"Holographic Entanglement Entropy of Periodically Driven Systems",

TBA

39. Yang, Zhao

"Holographic duality from random tensor networks",

Tensor networks provide a natural framework for exploring holographic duality because they obey entanglement area laws. They have been used to construct explicit simple models realizing many of the interesting structural features of the AdS/CFT correspondence, including the non-uniqueness of bulk operator reconstruction in the boundary theory. In this article, we explore the holographic properties of networks of random tensors. We find that our models obey the Ryu-Takayanagi entropy formula for all boundary regions, whether connected or not, a fact closely related to known properties of the multipartite entanglement of assistance. Moreover, we find that all boundary regions faithfully encode the physics of their entire bulk entanglement wedges, not just their smaller causal wedges. Our method is to interpret the average over random tensors as the partition function of a classical ferromagnetic Ising model, so that the minimal surfaces of Ryu-Takayanagi appear as domain walls. Upon including the analog of a bulk field, we find that our model reproduces the expected corrections to the Ryu-Takayanagi formula: the bulk minimal surface is displaced and the entropy is augmented by the entanglement of the bulk field. Increasing the entanglement of the bulk field ultimately creates the analog of a black hole, with an associated Hawking-Page phase transition. Extrapolating bulk correlation functions to the boundary permits the calculation of the scaling dimensions of boundary operators, which exhibit a large gap between a small number of low-dimension operators and the rest, a known necessary condition for holography. While we primarily focus on the AdS/CFT case, the main results of the article define a more general form of bulk-boundary correspondence which could be useful for extending holography to other spacetimes.

40. Zhang, Yun-Long

"Rindler Fluid and Its Properties",

Rindler fluid is a special fluid dual to vacuum Einstein gravity, which lives on the time-like hypersurface in an accelerating frame. Through imposing the Petrov type I condition and Hamiltonian constraint, the stress tensor of Rindler fluid can be recovered with correct first and second order transport coefficients, which lead to an interesting recurrence relation. I will also show some related progresses on this topic.